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APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

SYSTEM AND APPARATUS FOR IVR PORT SHARING

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This application claims the benefit of U.S. Provisional Application No. 60/088,516, filed June 8, 1998.

BACKGROUND AND SUMMARY OF THE INVENTION

The present invention relates generally to telecommunications systems and apparatus, and more particularly, to a system and apparatus for handling a plurality of calls to an interactive voice response ("IVR") system.

In order to make the most efficient use of IVR ports, the present invention provides a system for dynamic port allocation based on DNIS (i.e., dialed number identification system, e.g., the incoming number, such as an 800 number). In an installation where the IVR voice channels are wired to the station side of the PBX switch, each IVR channel may have a single application program hard-assigned. Then these channels may be grouped into hunt-groups (from the PBX perspective) so that calls for each application may be routed to the hunt group for a specific client application. The channels in that hunt group may answer calls only for that client application and no other. This type of arrangement, while functional, is very inefficient because the number of channels assigned to a client's hunt group has to be large enough to handle the peak call volumes while during lower call volume periods many of the channels go unused.

A more efficient method of IVR channel use is to group all channels of an IVR box into one hunt group and then assign the client application dynamically, as the call arrives. This way, the channels are busy handling the mixed call volumes of many client projects and are available

for any peak period of any project. The present invention is a unique "port sharing" system which is adapted to make maximum use of a limited IVR port resource.

In order to do dynamic port allocation, the IVR must be made aware of the incoming number that was called (usually an 800 or 900 number) before the call is actually answered. With the present invention the DNIS information may be passed to the IVR out-of-band (on a separate digital link) so that the IVR can allocate the correct application in a very short period of time (typically less than 500 milliseconds after the call arrives on the PBX switch).

The basic data flow for port sharing under the present invention is this:

1. The Call arrives on the PBX.

2. The PBX passes the DNIS and ANI ("Automatic Number Identification" of the phone from which a call is made, i.e., the calling number) information on to the telephony server.

3. The server formats the information and sends it to a background process on the IVR.

4. The background process determines that the message is meant for a port on this particular box and saves the DNIS and ANI data in memory.

5. The call arrives at the IVR port.

6. A special application that is preferably hard-assigned to every IVR port notices the port has an arriving call and asks the background process for the DNIS and ANI information.

7. The special application looks the DNIS up in a table, determines the correct application and executes that application on the port.

In addition to the novel features and advantages mentioned above, other objects and advantages of the present invention will be readily apparent from the following descriptions of the drawings and preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic diagram of one preferred embodiment of the present invention; and

Figure 2 shows a diagrammatical view of one embodiment of a CTI system adapted to function with the present invention.

DETAILED FUNCTIONAL DESCRIPTION

Referring now to Figures **1** and **2**, there is shown a preferred embodiment of the present invention using a Conversant IVR product (by Lucent Technologies) and a Nabnasset VESP CTI Middleware Software Product (by Quintus Corporation). As the communication steps are identified in Figure **1**, they are described below:

1. A call arrives at the PBX switch (e.g., DEFINITY by Lucent Technologies).

2. The switch follows the vector instructions and queues the caller to a Conversant ACD split.

3. The PBX notifies the VESP TS server of a new call which is being directed to a monitored extension.

4. The TS server requests that the VESP VDU server create a new VDU and assign a unique VDU ID.

5. The TS Server notifies the VESP VOX server that a call destined for an IVR port has arrived (the VOX is responsible for maintaining a state model of all IVR ports).

6. The VOX server waits to see that the call arrives at the IVR port.

7. The voice port of the IVR box recognizes an incoming call either via ring current (analog ports) or Tl messaging (Line Side T1 ports). The IVR automatically starts the application program assigned to every port called route_call.

8. The route_call application takes the phone off-hook.

9. The PBX informs the TS Server that the extension has gone off-hook.

10. The TS Server informs the VOX server of the off-hook state change.

11. The VOX Server issues a Script.Qualify 1 method call to the Scripter Server.

12. The Scripter maintains an internal table of all of the IVR machines monitored by the VOX server. It creates an ISDN-formatted message that includes the ANI, DNIS, CALLED EXTENSION, and AGENT_EXTENSION information and passes this message on to all IVR's using a Remote Procedure Call (RPC).

13. The remote procedure (to_d28()) is contained in a program running on the IVR machines called CTIEar. The RPC facility is maintained in such a way that the TCP channel opened by the RPC is left open indefinitely to speed subsequent message passing.

14. The CTIEar program receives the message and passes it onto a UNIX message queue that is monitored by a unique program called DIP28_isdn.

15. The DIP28_isdn program receives the message from the message queue and determines if it is meant for this particular IVR box by matching the AGENT_EXTENSION against a list of the extensions known to be wired to this IVR.

16. If the message was in fact meant for this IVR box, the data is stored in memory for later retrieval.

17. The unique route_call application requests the ISDN information from DIP28_isdn using the get_ANI External Function call.

18. The DIP28_isdn program returns the information to route_call. If the information has not yet arrived (a rare occurrence) the route_call application sleeps for a small time period and asks for the information again and eventually the information is passed.

19. The route_call application parses the information and uses the DNIS value to perform an Oracle table lookup.

20. Assuming the Oracle table (ROUTE_APPL) contains an entry for this DNIS, a field in the table contains the name of the application program associated with that DNIS and route_call executes that application.

21. If any of this protocol breaks down, the route_call application is programmed to ask the caller to re-enter the 800 number they have dialed and it uses that response to search the ROUTE_APPL table via a different field.

The IVR systems of the present invention utilize a call's ISDN information to dynamically assign applications to channels. This may be called "Port Sharing" because any given IVR port can be used by any client application to provide IVR service. This is much more efficient than hard-assigning client applications to individual ports and allows very high port utilization.

Hundreds of IVR ports may be shared by multiple applications. Based on the called DNIS, the correct application is dynamically assigned to the correct ACD extension that is wired to an IVR port. This may be done without connecting the IVR's to the PBXs with BRI links; without using the CONVERSE vector step to pass the DNIS using DTMF (because it adds too much time to the call duration); and over the method of CTI outside of VESP that involved

gateway systems which communicated with the switch using ASAI/BRI links and passed the incoming call information to the IVR's during call setup.

During call setup the DNIS and ANI information is collected by the IVR before the port even detects ringing. This speeds the call setup process. Since the information is being passed in parallel with the PBX sending a ring signal to the IVR port, virtually no time is added to the total call duration (thus saving toll charges).

The information from the CTI server is passed via TCP/IP sockets and is collected by a DIP on the IVR and stored in temporary memory. When the port detects ringing, a locally developed application called route_call, which is assigned to the port, requests the ISDN information from the DIP and uses a table lookup to start the correct application on that port. On VESP enabled ports, route_call also initializes the call with the VOX server by issuing the "newcall" method and obtains the VDU ID for that call. The ISDN information and VDU ID are passed to the intended application program as needed.

Under an alternative VESP design the IVR waits for the port to detect ringing before initiating requests for DNIS and ANI information from the VDU. The IVR may generate three transactions with VESP: 1) the newcall transaction to obtain the VDU ID; 2) a getvdu transaction to obtain the DNIS; 3) another getvdu to obtain the ANI. These transactions add some amount of time to the call duration, perhaps a second or more, which when taken on a per call bases may not seem significant, but when multiplied by millions of IVR calls that may be taken each month becomes very significant. Thus, while this embodiment works, it is not preferred over the embodiment shown in Figure 1.

When viewed in the most fundamental terms, the IVR may be treated like any other VESP client. The screen-pop function works on an agent workstation because the necessary information is sent to the workstation unsolicited before the agent hears the zip-tone (or ringing). The IVR reacts to real-time events presented by the callers. The present invention allows the VOX server to send information on to the IVR, unsolicited, at the time of an IncomingCall event as detected by the Telephony server. At a minimum the information content may be DNIS, ANI, and ACD extension. Ideally, the information passed should be user definable. Additional information may include such items as caller's name, account number, account balance, etc., to be passed before the call begins. The IVR might answer: "Thanks for calling XYZ Corp. Mr. Smith. When you last called you requested an account statement be mailed to you. How can we serve you today?"

Several qualities make the present invention unique, including:

1. Port Re-Use

Any IVR port in the call center can be used for any application. Beyond the initial database record that relates a DNIS to an application, there is no special set-up required for each project or each 800 number to re-use an IVR port.

2. Out-of-Band Communication

The present invention transfers the call information (i.e. ANI and DNIS) to the IVR system on a communications channel that is completely separate from the voice channel being used by the caller to talk to the IVR. This makes the port-sharing effort very efficient because the call data is communicated in parallel to the call being switched to the IVR and the IVR can know which application to start even before the phone "rings".

Out-of-Band communication also simplifies the administration of the call flow - that is, the call flow designer does not have to take port-sharing into consideration when deciding to include an IVR in the design.

3. Client/Server Architecture

The IVR is simply one part of a larger system that encompasses many clients and servers (PBX, CTI Server, Administration Servers, etc.). Adding new IVR's or new CTI servers is routine and does not require any additional programming or infrastructure changes.

4. Application Program Transparency

IVR application "scripts" need not be aware of the port-share system. A script can be designed and tested without consideration being given to the port-sharing. Then, when implemented into production, the script will automatically work under the port-sharing system of the present invention. If, however, the application wishes to make use of the call data (ANI and DNIS), that data can be procured from the port-sharing system.

5. Data Cache

The call data is communicated once to the IVR when the call is originally set up and is cached there for subsequent use by the port-sharing system or by the application scripts if desired.

The system and apparatus of the present invention offer many additional advantages. With the present invention, two way communication between the PBX switch and the CTI server is available. The "hook-flash" method of transferring a voice or phone number is no longer necessary. Coordinated voice/data call transfer is seamless with the present invention. Intelligence may be added to the system via a database that may be accessed by the CTI server

and knowledge obtained therefrom may be directed to a live agent's terminal screen. A single list of DNIS numbers may be maintained on the IVR instead of the IVR and the CTI server. Also, the present invention is adapted to manage the IVR ports state before, during, and after each call.

While the above preferred embodiment has been described with reference to particular, well known vendor equipment, it is to be understood that the invention is not limited to the preferred embodiments, and it is adapted to be accomplished using many variations and varieties of hardware and software. The preferred embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The preferred embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described preferred embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.